knight®

KG-870 70 WATT TRANSISTOR STEREO AMPLIFIER

OPERATOR'S MANUAL

KG-870 70-WATT TRANSISTOR STEREO AMPLIFIER

Advanced solid-state engineering by Knight Electronics provides an amazing, versatile and dependable transistor stereo amplifier, the KG-870. This unit is designed to meet the demands of even the most critical listener.

Incorporate this fine amplifier as the heart of your stereo system, and turn on the power. The amplifier plays immediately, as it needs no warm up. 22 transistors and 4 silicon diodes provide the ultimate in distortion-free performance, performance that will be enjoyed for years. The KG-870 is directly coupled to your speakers; there are no blocking capacitors or output transformers to introduce distortion or mar faithful reproduction.

70 watts of music power (35 watts per channel) is effortlessly provided with minimum heat, complete freedom from microphonics, and extremely low power drain. Peak music power rating is 140 watts.

The KG-870 provides you with a complete complement of controls, to perform every necessary function, along with a front panel stereo headphone jack for private listening.

Striking Sierra gold and charcoal styling, plus either the oiled walnut or metal accessory case makes the KG-870 a handsome addition to any decor. This unit may also be custom mounted in any desired cabinet.

GUIDE TO STEREO LISTENING

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SPECIFICATIONS

Power Output

8 Ohms — 70 watts IHF music power, 35 watts per channel; 140 watts peak music power; 28 watts continuous sine wave power per channel.

16 Ohms — 56 watts IHF music power, 28 watts per channel; 112 watts peak music power; 22 watts continuous sine wave power per channel.

Frequency Response — ± 1db 20 to 25,000 cps at rated power output.

Harmonic Distortion — 0.5% at rated power output.

Intermodulation Distortion — Less than 1% at rated power output 60 cps and 7kc mixed 4:1.

Hum and Noise

Tuner	80 db below rated power
Mag Phono	68 db below rated power
Tape Head	60 db below rated power
Aux.	80 db below rated power

Input Sensitivity and Impedance (for rated output)

Input	*Sensitivity*	*Impedance*
Tape Head	2 millivolts	200K ohms
Mag Phono	3 millivolts	200K ohms
Tuner	1 volt	500K ohms
Aux. #1	0.5 volt	150K ohms
Aux. #2	2 volts	620K ohms
Tape Mon.	0.5 volt	100K ohms

Separation — 40 db.

Tape Output — 0.5 volts 10K source impedance.

Output Impedance — May be used with 8 or 16 ohm speakers.

Not recommended for 4 ohm low-efficiency speaker loads.

Damping Factor — 17.5 when used with 16 ohm speaker.

12.5 when used with 8 ohm speaker.

Equalization

Tape Head — NARTB

Mag Phono — RIAA

Bass Cut or Boost — 15db at 50 cps

Treble Cut or Boost — 13db at 15 kc.

Controls — SELECTOR (tape-phono-aux-tuner), LEVEL, LOUDNESS, BASS, TREBLE, BALANCE, FILTERS (flat - rumble - scratch - rumble/scratch), SOURCE-TAPE MONITOR, STEREO-REVERSE, STEREO-MON, PHASE REVERSE, OFF-POWER.

Headphone Jack — Accepts all low-impedance stereo headphones.

Semiconductors — 16 signal transistors, 6 power transistors, 4 silicon diodes.

Line Voltage required — 110 volts to 125 volts, 60 cps AC only.

Power Consumption — 25 watts (no signal)

Power Receptacles — 2 switched

Fuses (3) — 1.5 amp in line, 3 amps in each power supply

Size (HWD) — 2¾" x 13" x 11"

See page 11 for equipment used to measure specifications

CONNECTING EQUIPMENT TO YOUR STEREO AMPLIFIER

General Rules:

1. **Always use shielded cable** to connect program-source equipment to the amplifier input jacks.

2. **Always turn the amplifier off before connecting equipment to,** or disconnecting equipment from the amplifier. If pin plugs are inserted or withdrawn from inputs while power is applied, strong hum voltages can be developed which may overdrive your speakers.

3. **While the amplifier is very efficient** in its use of power, it does dissipate some power in the form of heat. About 25 watts of power is dissipated under "no signal" conditions. Adequate ventilation must be provided to insure proper operation and long component life. The feet provided with the amplifier and the optional cabinets will provide proper air flow under the chassis. *Do not place the amplifier on top of a vacuum-tube tuner or similar heat producing piece of equipment.*

4. Place low-level program source equipment, such as a magnetic phono pickup or tape player, as close to the amplifier as possible.

   Excessive length of connecting cable to the tape head or mag phono inputs can cause hum pickup and loss of high frequencies.

5. Because of the high sensitivity of this amplifier it is recommended that shorted phono plugs be inserted in all unused low-level input jacks. TAPE HEAD and MAG PHONO ARE YOUR low-level jacks.

Record Changer or Turntable

Determine what type of phono cartridge you have. Connect magnetic types as as the Empire, Pickering, Shure Dynetic, etc. directly to the MAG PHONO jacks. If you have a ceramic cartridge, check to see whether it is a high-level equalized type or a low-level type which requires some sort of network. Many high-quality, low-level ceramic cartridges have been introduced in recent years. Most of these are supplied with a pair of equalizing networks. With the networks, you can connect them to the MAG PHONO inputs. See the cartridge manufacturer's instructions when in doubt about your cartridge.

The input impedance of the KG-870 is 200K ohms. This value will give satisfactory performance without loss of high frequencies, with any of the commonly used magnetic phono cartridges. If, however, you wish to terminate your cartridge in the resistance recommended by the manufacturer, two resistors of the recommended value should be installed. Solder one from terminal 3 to terminal 2 of J-1. Solder the other from terminal 2 to terminal 1 of J-1.

The less expensive, high-level, ceramic cartridges have outputs of .1 volt or more. Connect this type of cartridge to the AUX 1 input.

Tuners

FM and FM-AM tuners with built in multiplex. Connect the tuner outputs to the TUN inputs. Tuner input sensitivity is 1 volt. If your tuner has an output level control, set it to match the level you get in the PHONO position, if you are using a record player.

FM tuners used with multiplex adaptors. Connect the adapter outputs to the TUN input jacks. Note: if your adapter does not contain a "feed-through" arrangement you can also connect the regular FM output of your tuner to one of the AUX input jacks. This allows you to bypass the adapter.

Separate AM tuner. Connect the output of this unit to one of the AUX input jacks.

Tape Equipment

Tape Transport (basic playback unit with no preamplifier). Any tape player with high-impedance heads (these are commonly used in this type of unit) can be connected to the TAPE HEAD inputs. These inputs are equalized for 7½" per second tape recordings.

Tape Recorder with preamplifier. Connect the "line" input jacks of the recorder to the REC output jacks of the amplifier. On a **two-head** recorder, connect the recorder output jacks to either pair of AUX input jacks of the amplifier. Determine experimentally which sensitivity best suits your needs. If you have a **three-head** recorder, connect the recorder output jacks to the TAPE MON input jacks of the amplifier. This allows you to monitor tape quality continuously as you record.

Note: The SOURCE-TAPE MONITOR switch must be in the TAPE MONITOR position to playback tapes when using the TAPE MON jacks.

AC Power Receptacles

Two AC power receptacles are provided for connecting associated equipment, such as: tuners, turntables or tape recorders. These receptacles are switched with the amplifier OFF-POWER switch. The receptacles are not fused. *Do not connect units drawing much more than 100 watts to these receptacles.* Check the manufacturer's specifications for power consumption.

Speakers

Connect the wires from the left speaker system to the LEFT SPKR terminals.

Connect the wires from the right speaker system to the RIGHT SPKR terminals of the amplifier.

If you have two or more speaker systems for each channel, see pages 7 and 8 for the correct connections.

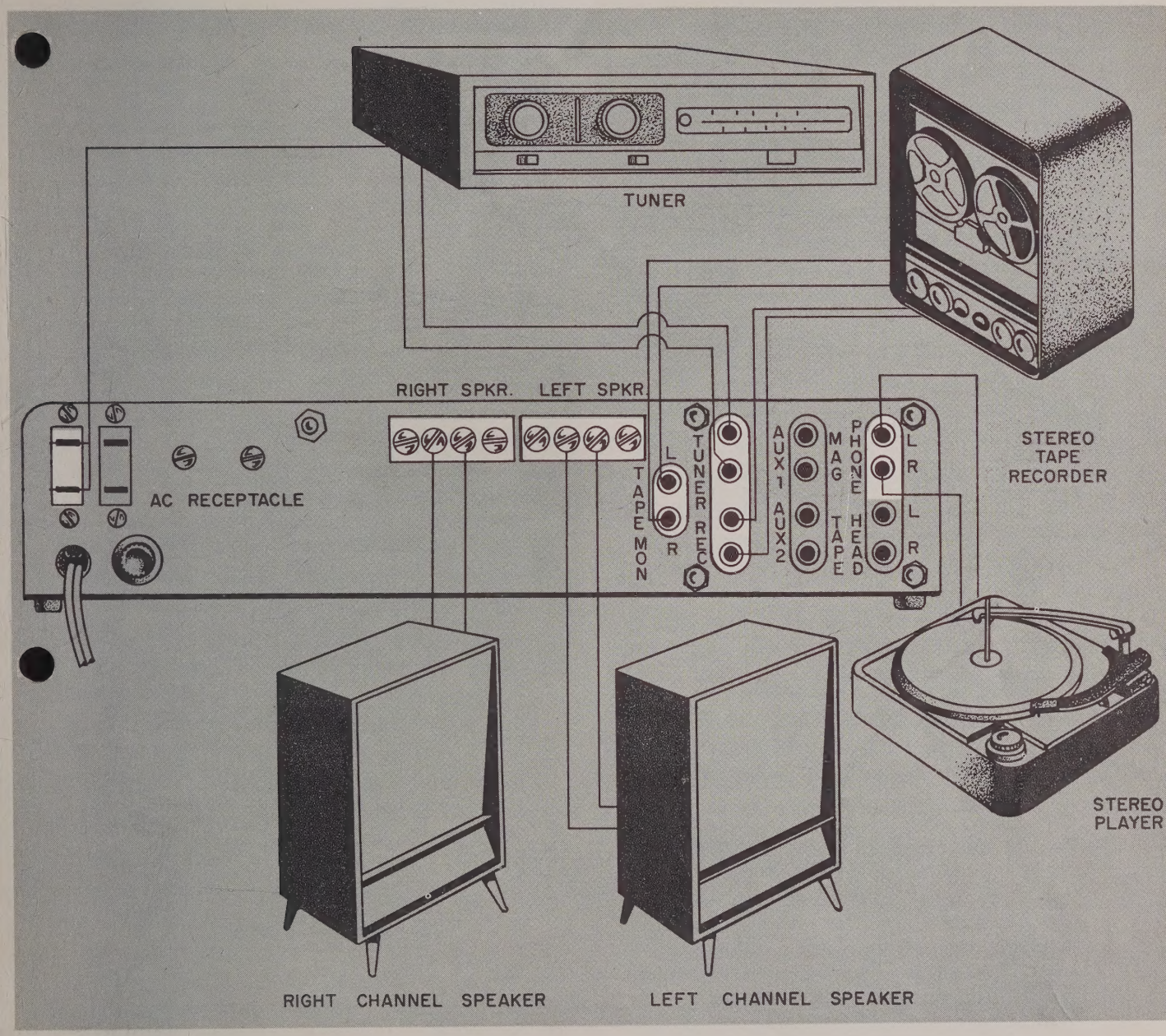


FIGURE 1. HOW TO CONNECT EQUIPMENT TO YOUR STEREO AMPLIFIER

CAUTION

Do NOT set the amplifier on a metal surface where the outer shells of the power transistors can short to the chassis or one another. If the unit is placed on a *flat* metal surface, the feet will provide adequate clearance for the power transistors.

OPERATING THE AMPLIFIER

☐ Connect all equipment to the amplifier. Connect speakers to the left and right speaker terminals.

CAUTION: NEVER TOUCH ANY OF THE WIRING WHILE THE AMPLIFIER IS PLUGGED INTO THE POWER OUTLET.

☐ Set the POWER switch to OFF. Turn the LEVEL control fully counterclockwise. Plug the line cord into a 110-130 volt, 60 cycle AC receptacle.

☐ Plug the line cords of other system components into the AC receptacles of the amplifier, if you want these components to go on and off with the amplifier.

☐ Turn on the program source unit you wish to hear (tuner, phonograph, etc.) and set the amplifier SELECTOR to the corresponding input.

☐ Set the TAPE MONITOR switch to SOURCE, the STEREO-MON SWITCH to STEREO, and the FILTERS switch to FLAT.

NOTE: Always leave the TAPE MONITOR switch in the SOURCE position unless you wish to monitor while you are recording a tape.

☐ Set the LOUDNESS control fully clockwise (flat position). Set the BASS and TREBLE controls so the dots are in line with the vertical line above them

☐ Turn the amplifier on by setting the OFF-POWER switch to POWER. NOTE: A slight "thump" may be heard from the speakers at the instant the amplifier is turned on. This is normal and simply indicates that the power supply is stabilizing. Turn the LEVEL control clockwise to set the desired volume. Adjust the BALANCE control for the most pleasing stereo effect, or equal volume from each speaker if you are listening to monophonic material.

☐ Try selecting each of the program sources that you have connected to the input jacks. Note the comparative levels from one source to the next for the same setting of the amplifier LEVEL control. If your tuner has an output level control, set it so you get a minimum difference in volume between PHONO and TUNER operation. If you are using the AUX inputs, consider at this time which pair, #1 or #2, gives most nearly the same level as PHONO.

PHASING THE LEFT AND RIGHT SPEAKERS

For the best bass reproduction, the left and right speakers should operate "in phase", that is, the speaker cones of the bass speakers should move in and out together. When speakers operate out of phase, there is cancellation of sound at some low frequency. Just how low this frequency is, or how noticeable the cancellation, depends on the spacing between your speakers. The farther apart they are spaced, the less noticeable will be the loss of bass.

To determine if your speakers are operating in phase, do the following:

☐ Temporarily move the speakers as close together as possible. Keep them side by side, not facing one another.

☐ Play some music which is rich in bass tones through your stereo system. Set the STEREO-MON switch to MON and turn the BASS control fully clockwise. Listen to the depth of the bass for a while, then set the PHASE-REVERSE switch to its other position. If the bass is more pronounced now your speakers are correctly phased. If there is less bass now, return the PHASE-REVERSE switch to its original position. Move your speakers back to their proper locations.

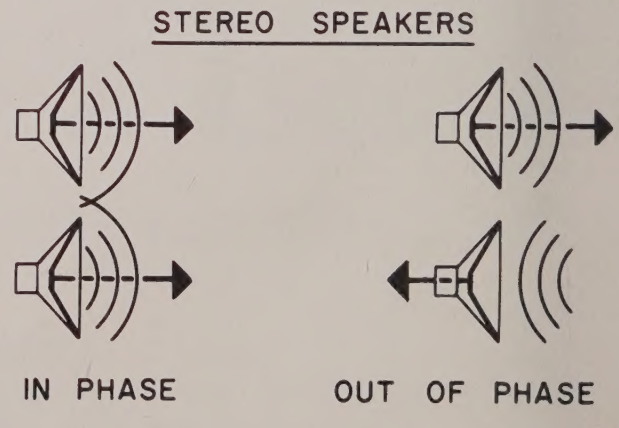


FIGURE 2. STEREO SPEAKERS SHOULD BE PHASED

STEREO SPEAKERS

Good stereo reproduction requires two matched speaker systems properly oriented with respect to the listener. The term matched speakers means speakers that sound alike, not necessarily identical speakers. If you can't use identical speakers the next best thing is to use speakers that sound alike **except** in the low bass region. The reason for this exception is that the sense of direction (the primary reason for stereo) is lost in the very low bass regions. Thus if you already own a large and expensive speaker system and space or budget doesn't warrant duplicating this system there is an alternative. Choose a second speaker which sounds most like your original one in the middle and high frequency regions. If your original speaker system was of the 3-way type you can usually obtain a duplicate tweeter and mid-range unit and house them in a much smaller cabinet along with a smaller woofer or bass speaker.

Speaker Placement

Figure 3 indicates the optimum relationship between the listener and the speakers. The recommended 40 degree angle is not critical. Just try to keep the speakers separated by about ½ to ¾ the distance from them to the listener.

Experiment with the placement of your speakers because every room has its own acoustical properties and decorating problems.

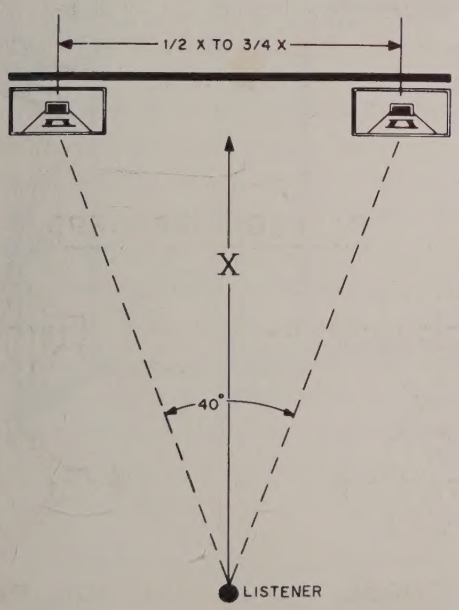


FIGURE 3.
STEREO SPEAKER PLACEMENT

MULTIPLE SPEAKER INSTALLATION

Additional speakers may be added to your amplifier, if desired. These speakers are usually used to provide music to other parts of the home. The additional speakers may be installed if the following requirements are met.

The two channels of the KG-870 must not be connected to each other in any case.

The total load of the additional speakers must represent an impedance of from 8 to 16 ohms to the SPKR terminals of the amplifier. If the speakers are not properly connected, either considerable power will be lost, or the amplifier will be overdriven.

Figure 4, on page 8 shows the proper connection of multiple speakers to one channel of the amplifier. Any combination of speakers that will represent a proper load to the amplifier may be connected to the other channel. These loads do not necessarily have to be the same, as the balance control will compensate for any difference in volume that might occur.

NOTE: A commercially manufactured two- or three-way speaker system utilizing a proper crossover network should be considered one speaker of the impedance stated in the manufacturer's specifications.

PHASING MULTIPLE SPEAKERS

Multiple speaker installations require that all of the speakers located in the same room operate IN-PHASE. First phase the speakers in each channel as outlined in this section; then refer back to page 6, and phase the RIGHT and LEFT channel.

PHASING TWO OR MORE SPEAKERS IN ONE CHANNEL

Move the speakers close to each other, side by side. Disconnect the speakers connected to the other channel. Play some music that is rich in bass tones, and turn the bass control clockwise. Listen to the bass content of the music for a few minutes, and then reverse the connections on one of the speakers. Listen to the music again and notice if the bass tones seem to increase.

If the bass tones seem to increase, leave the wires connected in this manner. If the bass tones do not increase, or seem to decrease, re-connect the wires in their original position. Repeat this operation for each additional speaker in this channel. When all speakers in the same room are phased, mark the terminals and wires connected to them. This will help to re-connect the speakers properly if they ever need to be disconnected at any time in the future.

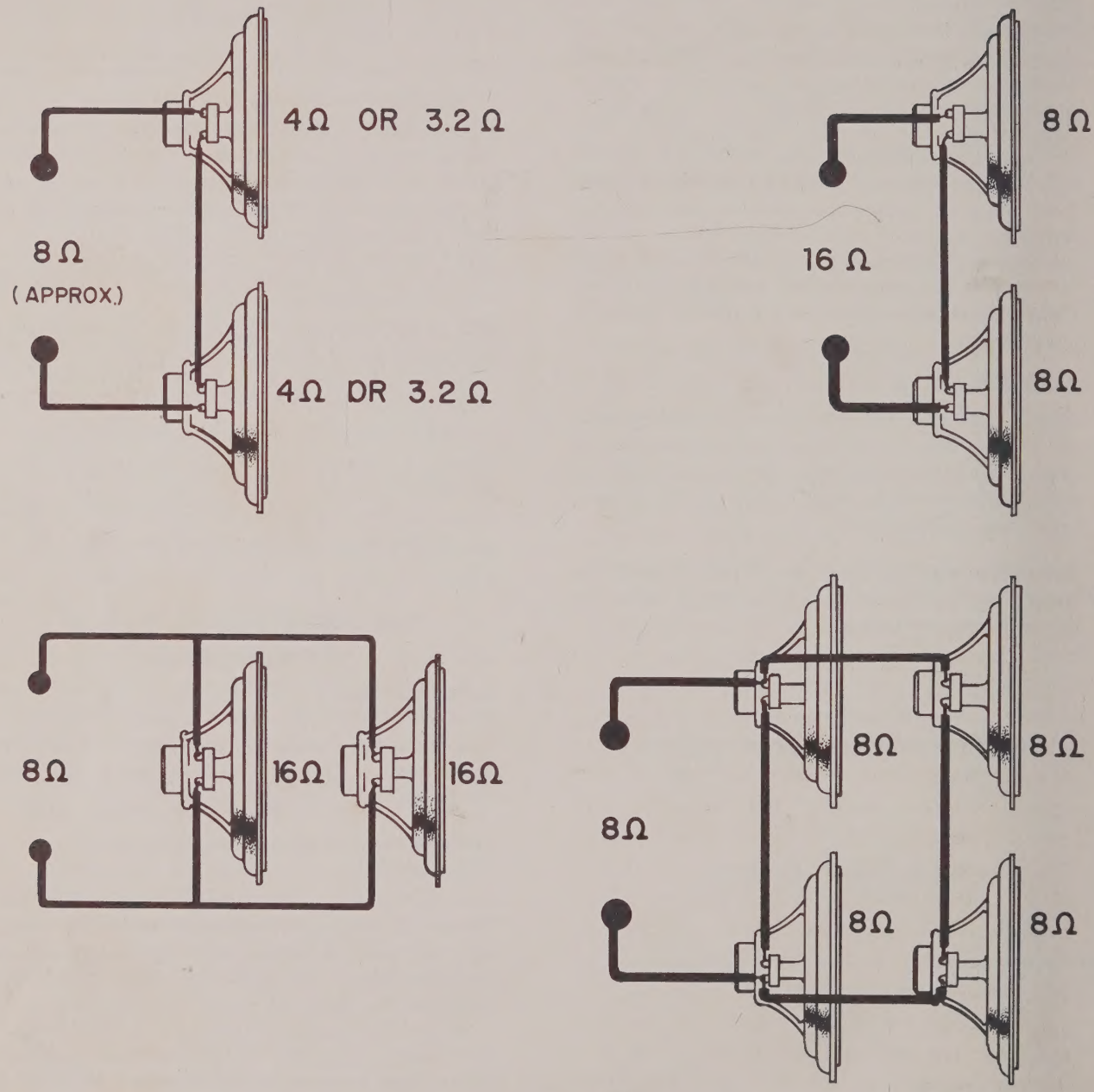


FIGURE 4. MULTIPLE SPEAKER CONNECTION— ONE CHANNEL SHOWN

CONTROL FUNCTIONS — TOP ROW

SELECTOR should be placed in the position corresponding to the program source you wish to hear (PHONO, TUNER, etc.). Its function is to select a pair of inputs to be connected to the amplifier circuits. Note: The SELECTOR switch and the inputs are disconnected unless the TAPE MONITOR switch is set at **SOURCE.**

LEVEL is used with the LOUDNESS control to set the desired volume. The LEVEL control changes the gain of the amplifier and hence the volume, without affecting tonal balance. That is, when LEVEL is turned up, all signal frequencies (tones) applied to your speakers increase equally in amplitude. When the LOUDNESS control is fully clockwise, the LEVEL control functions as a simple volume control.

LOUDNESS is used to compensate for the "Fletcher-Munson" hearing characteristics. Briefly stated, these men found that at lower listening levels most people lose some sensitivity to bass tones and very high tones. To compensate for this hearing deficiency, the LOUDNESS control changes the tonal balance as it is rotated from the full clockwise position. As it is turned, the volume will drop somewhat but the middle tones will decrease faster than the bass tones and treble tones. This results in an apparently normal tonal balance at low listening levels. If you prefer not to use this compensation, simply leave this control in the fully clockwise position.

BASS and TREBLE are clutch-type controls which can be adjusted to obtain the exact tonal balance you prefer for each channel.

To adjust one channel separately, for example the left channel, hold the inner knob in place and rotate the outer knob. Once the control is adjusted for both channels, the relative settings will remain the same. Then as you turn one knob the other knob will follow.

The vertical lines above each control show the flat (no boost or cut) position. For less treble or bass turn the controls counterclockwise. For treble or bass boost turn the controls clockwise.

BALANCE controls the relative volume of your left and right speakers. As you turn the control counterclockwise, the volume of your right speaker will decrease. Turning clockwise from center, will decrease the volume of the left speaker. The center position provides equal volume from both speakers (if they are identical.) Room furnishings may also change balance settings.

Correct volume balance between your left and right speakers is essential for full enjoyment of stereo. Turn the control through its range to acquaint yourself with its effect.

FILTERS

The FLAT position is the wide-band position in which no networks are introduced to alter the frequency response of the amplifier. The RUMBLE position provides a sharp cutoff of response below about 25 cycles per second. This characteristic is useful for eliminating the low frequency noise or rumble generated by some record playing equipment.

The SCRATCH position provides a sharp cutoff of response at the high frequencies to minimize noise from worn records, distant FM stations or noisy tape recordings.

The RUMBLE/SCRATCH position introduces both filters at the same time.

SWITCH FUNCTIONS — BOTTOM ROW

SOURCE-TAPE MONITOR controls the use of the amplifier with a tape recorder. **THIS SWITCH MUST BE LEFT IN THE SOURCE POSITION** unless you wish to monitor a recording while it is being made. This switch must also be in the SOURCE position when playing back tape directly from the tape head of a tape transport.

Use the ***MONITOR*** position:

1. To play back a recorded tape on your tape recorder and listen through your stereo system (assuming your tape recorder outputs are connected to the TAPE MON inputs).

2. To monitor as you record. Your recorder must have 3 tape heads and separate record and playback amplifiers for this use. This allows you to feed any program source selected by the SELECTOR switch to the inputs of the recorder. At the same time you can listen to a "playback" of what has just been recorded on the tape. If you switch back and forth between SOURCE and MONITOR you can get an "A-B" comparison of source quality versus taped quality.

   Remember, unless this switch is set in the SOURCE position, the inputs and the selector switch will be disconnected from the amplifier output.

STEREO-REVERSE is used to transpose the two channels. Setting this switch in the reverse position will cause the left input signals to be reproduced by the right speaker and vice-versa.

STEREO-MON is used to connect the two amplifier channels in parallel. Use the STEREO position for all stereo reproduction. Use the MON position to listen to a monophonic program source which has been connected to only one jack of an input pair. This allows you to listen to a monophonic source from both speakers.

The MON position is recommended for listening to monophonic records with your stereo pickup cartridge.

PHASE-REVERSE will normally be set only once after connecting speakers (see "Phasing the Left and Right Speakers" on page 6). This switch reverses the phase of the right channel speaker.

OFF-POWER controls the power applied to the amplifier and the accessory AC receptacles. Place this switch in the POWER position to energize the amplifier and receptacles.

HEADPHONES. This stereo headphone jack is a three-conductor type (ring, tip and sleeve). The jack is intended for use with any high-quality, low-impedance headphones. When you insert the phone plug into this jack, the headphones are placed directly in parallel with the speaker terminals.

Because phones have a much higher sensitivity than speakers, the output level of the amplifier has been designed to drop by a comparable amount. Thus, if you are listening to the speakers at a given level, then plug the phones in and you will hear approximately the same level in the phones. Note however that the speakers will become almost inaudible.

This allows you to listen at full room volume without disturbing anyone else.

PLAYING MONAURAL RECORDS WITH A STEREO CARTRIDGE

When playing monaural records with a stereo cartridge, place the STEREO-MON. switch in the MON. position. This will cancel turntable rumble and any other vertical noise components that may be present in the cartridge output.

RECORD AND STYLUS CARE

To keep stereo records in good condition, they should be treated with the care they deserve.

1. Stylus (needle) pressure should be kept to the minimum needed for good tracking. Follow the cartridge manufacturer's recommendations for stylus pressure. An inexpensive stylus pressure gauge will allow you to check the needle pressure from time to time and will prove to be a good investment.

2. **Keep your records clean.** Dust is a destructive abrasive and causes wear of both stylus and record grooves. Clean records often with a soft sponge moistened with clear, cold water or a record cleaning cloth.

3. Brush the stylus often with a soft, camel's hair brush. Considerable distortion will result if the stylus is allowed to accumulate fuzz. NEVER RUB YOUR FINGER AGAINST THE STYLUS—Stylus alignment may be distorted.

4. **Change stylus as needed.** Although diamonds last much longer than sapphire tips, no stylus stays in good condition forever.

STEREO TAPES

Stereo tapes are an increasingly popular program source. The tapes require no special care other than avoiding extremes of temperature and humidity. However, routine care of the tape heads will assure continued high quality of reproduction, play after play. Routine care includes cleaning the tape heads with tape-head cleaner and demagnetizing the heads. Some enthusiasts recommend cleaning heads after 10 hours of use, demagnetizing after 50 hours.

Refer to the recommendations made by the manufacturer of your tape equipment for specific instructions.

HOW SPECIFICATIONS WERE MEASURED

Below is a list of the instruments that were used to establish the specifications of the KG-870. Test instruments used to verify the specifications must be of comparable quality.

Hewlett Packard Model 400D, AC VTVM

Hewlett Packard Model 200 CD, Audio Generator

Tektronix Model 531, Oscilloscope

Altec Lansing T1—401 Dual Frequency Generator

Altec Lansing T1—402 Intermodulation Distortion Analyzer

Barker Williamson Model 410 Audio Distortion Analyzer

Output measurements were made into an 8 ohm resistive load. The rated power referred to is the continuous sine wave power of each channel measured separately.

CAUTION: The half bridge output circuit used in this amplifier draws current from the power supply directly proportional to the input signal level. This means that as the signal level to the output stage increases, the power drawn from the power supply increases also. The two 3-amp fuses in the power supply are used to protect the output transistors from excessive current. The application of a continuous sine wave signal that drives the amplifier in excess of its rated power will cause the fuses to open. Do not operate the amplifier at its rated power with a continuous sine wave source for extended periods.

This caution does not apply to high level music signals, as they are not of a continuous sine wave nature and occur for only extremely short time intervals.

SERVICE INFORMATION

HUM

Sometimes hum is picked up by a stereo system even though each unit in the system is relatively hum free. Hum can usually be eliminated by taking one or more of the following steps:

1. **Remove external hum sources.** Electric clocks, fluorescent lamps and power equipment are sources of hum which can be picked up by your system. Such electrical appliances should not be placed too close to your music system. Remove any suspected appliances and note if the hum level decreases.

2. **Reverse the position** of each line cord plug in the socket, one at a time, to find the position which results in least hum.

DISCONNECT ALL UNITS FROM THE POWER LINE BEFORE TRYING THE FOLLOWING STEPS:

3. Check component placement. To minimize hum, magnetic record player cartridges should be at least 1 foot away from amplifier or tuner power transformers. Power line cords should never be close to the interconnecting audio cables.

4. **Check interconnecting shielded cables.** Be sure the shield braid or spiral shield is properly soldered to the outside of the plug and that each is firmly seated all the way in the jack.

5. Twist together the two audio cables from your record player before you connect them to your amplifier.

6. **Connect a ground wire** (#18 wire or heavier) between the motor frame of your record player and the GROUND POST of your amplifier. Many record players have ground or "earth" terminals provided for this purpose. See Figure 4. In the same way, connect the motor frame of your tape recorder to the amplifier GROUND POST. If two separate tuners are used, connect the two chassis with a single ground wire; then connect just one of the tuner chassis to the amplifier GROUND POST.

7. Use a true earth ground, if hum persists. Connect a ground cable from the GROUND POST of your amplifier to a true earth ground such as a cold water or radiator pipe or a copper rod driven into the earth.

ACOUSTIC FEEDBACK

Rumble and squeal are often caused by acoustic feedback or the return of sound vibration from the speakers back into the record player. The simplest cure is to house each speaker in a separate cabinet, away from other components. Sometimes it is necessary to place a foam rubber pad under each speaker enclosure and move the speaker enclosures away from the wall to be sure that vibrations from the speakers do not travel along the wall or floor to other components. If the speaker must be mounted in the same cabinet as other components, the cabinet should be solidly built of heavy wood and the speaker compartments should be completely padded with a cushion of 1" foam rubber.

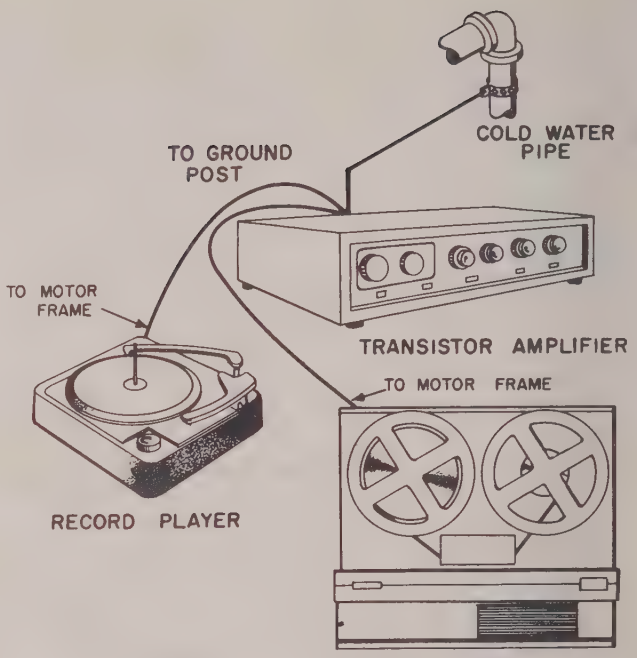


FIGURE 5.
USE OF GROUND WIRE

LOSS OF STEREO EFFECT

First check each channel, one at a time by turning the BALANCE control one way then the other. If both channels are operating but no separation is obtained check for the following:

1. **Incorrect speaker placement.** See Speakers.

2. **Record players.** Cartridge defective or incorrectly wired. Cartridge not mounted correctly.

Stylus Pressure too high. Stylus pressure above the recommended value distorts the stylus suspension and increases record wear. Check with a stylus pressure gauge and, if too high, reduce it to the minimum needed for good tracking.

Tape player. Improper head alignment. See manufacturers instructions for checkout.

Stereo Multiplex FM. Be sure station is broadcasting stereo. Try other stations if possible. Be sure tuner is accurately tuned in, since separation can be lost by only a slight mistuning in most tuners. Poor antenna systems will also cause loss of separation.

OPERATION NOTES

The pilot light may flicker slightly when playing the amplifier at extremely loud levels. This is normal and the result of the pilot light being connected to the +30 volt supply. DC operation of the pilot light assures you of the lowest possible hum and noise.

R-94 and R-95 are 7-watt resistors. These resistors are designed to dissipate considerable heat, and run very HOT. Do not touch them. Also TR-8, TR-9, TR-19 and TR-20 are designed to run warm, especially at high volume levels.

TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE	SERVICE PROCEDURE
UNIT DEAD		
Pilot lamp not lit, F-1, 2 and 3 not blown.	Open switch, linecord, or transformer primary.	Check switch and linecord. Check transformer T-1.
F-1 only blown, pilot lamp not lit.	Shorted diode, electrolytic capacitor, or transformer.	Check CR-1 thru CR-4. Check C-64 thru C-67. Check T-1.
F-2 and F-3 blown, pilot lamp out.	Shorted electrolytic capacitor, or power transistor. Power transistors removed and installed without insulating washers.	Check C-67 and 68. Check power transistors. Install insulating washers.
F-3 only blown.	Defective C-68 or C-58.	Check C-68 & C-58 and Replace F-3.
RIGHT CHANNEL DEAD		
F-2 blows, pilot lamp not lit.	Shorted C-57 or 67.	Check C-57 or 67. Replace F-2.
Left channel distorted, pilot lamp not lit.	F-2 blown.	Replace F-2.
Right channel dead.	Both filaments in I-1 open.	Replace I-1.
Right channel dead.	T-3 primary winding shorted.	Replace T-3.
R-94 smoking.	Shorted TR-18 or open TR-19. (27 volt drop across R-94 instead of 15 volts).	Replace TR-18 or 19.
Right channel dead.	Open TR-18. (voltage drop across R-94 approx. 6V instead of 15V).	Replace TR-18.
Right channel dead.	Shorted TR-19 (voltage drop across R-94 approx. 4V, instead of 15V).	Check TR-19 and replace if shorted.
LEFT CHANNEL DEAD		
R-95 smoking.	Shorted TR-7 (voltage drop across R-95 27V. instead of 15V). Open TR-8 (voltage drop across R-95 27V. instead of 15V).	Check TR-7 and replace if necessary. Check and replace TR-8 if necessary.
Left channel dead.	Shorted TR-8 (voltage drop across R-95 zero volts).	Check TR-8 and replace if necessary.
Left channel dead.	Open TR-7 (voltage drop across R-95 approx. 3V instead of 15V).	Check TR-7, replace if necessary.
Left channel dead.	Shorted TR-8 (Zero volts across R-95).	Check TR-8 and replace if necessary.
Left channel dead.	Both filaments of I-2 open.	Check I-2 and replace if necessary.
Left channel dead.	Shorted primary T-2.	Check transformer. Replace T-2 if necessary.
DISTORTION		
Distortion in one channel only.	One filament in I-1 or I-2 open.	Check I-1 and I-2, replace if necessary.
Distortion, both channels.	One secondary of T-2 or T-3 shorted. Shorted emitter to base of TR-10, 11, 21 or 22.	Check and replace T-2 or T-3. Check transistors, replace if necessary.
Oscillation on one or both channels.	Poor ground connection(s).	Check entire single point ground system for open connections.
MISCELLANEOUS		
Amplifier plays normally, one channel only.	Defective transistor.	Determine which channel is at fault. Interchange like transistors from channel to channel until defective one is found. NOTE: Power must be off whenever transistors are changed.
Amplifier plays normally, one channel only. I-1 and I-2 are glowing.	Shorted output. Shorted R-98 thru 101.	Check value of R-98 thru R-101. Check output terminals for possible shorted condition.
R-94 and R-95 quite hot.	Normal condition, R-94 and 95 are 7-watt resistors, designed to dissipate considerable heat. DO NOT TOUCH R-94 AND R-95.	NONE, NORMAL CONDITION.
TR-8 and TR-19 running warm.	Normal condition. These are silicon transistors, designed to run warm.	NONE, NORMAL CONDITION.
I-1 and I-2 glowing intermittently while playing unit VERY loud on low impedance speakers	Amplifier being overdriven.	NONE, LAMPS ARE PROTECTING OUTPUT TRANSISTORS FROM OVERLOAD.

TRANSISTOR REPLACEMENT CHART

SYMBOL	PART NO.	REPLACEMENT
TR-1, TR-2, TR-12 & TR-13	660-082	2N2613 RCA OR EQUIV.
TR-3—TR-6 & TR-14—TR-17	660-081	2N1370 TI OR EQUIV.
TR-8 & TR-18	660-070*	2N2270 RCA OR EQUIV.
TR-7 & TR-19	660-074	2N2270 RCA OR EQUIV.
TR-9 & TR-20	660-076	2N553 DELCO OR EQUIV.
TR-10, TR-11, TR-21 & TR-22	660-077	2N1541 DELCO OR EQUIV.

* HIGHER β THAN 660-074

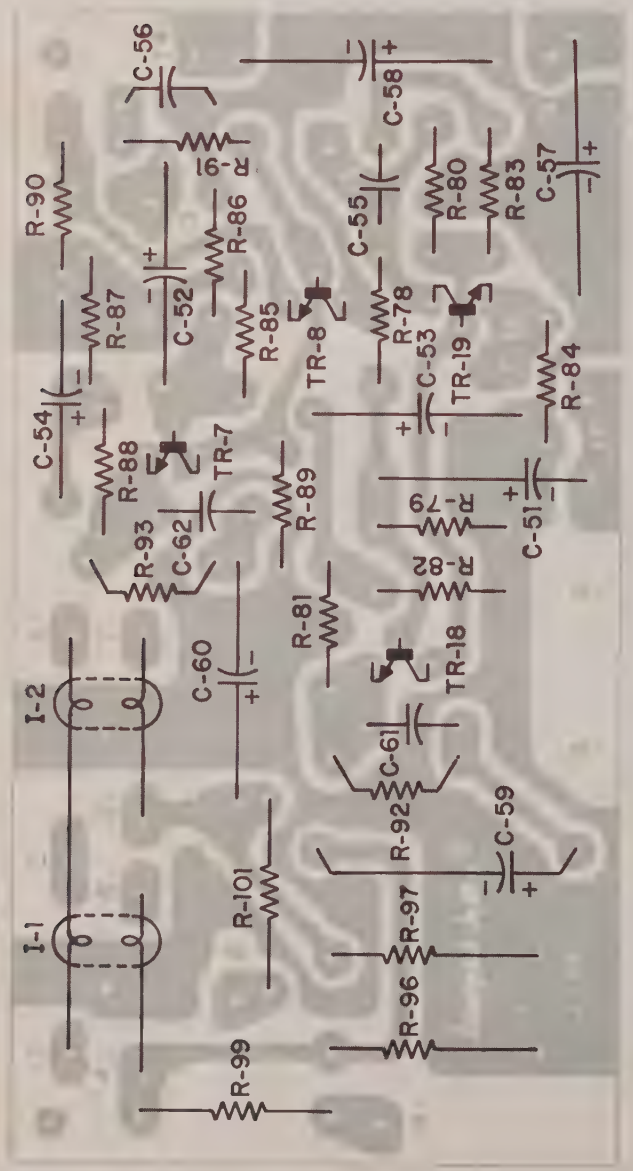


FIGURE 6. SMALL CIRCUIT BOARD SCHEMATIC DIAGRAM

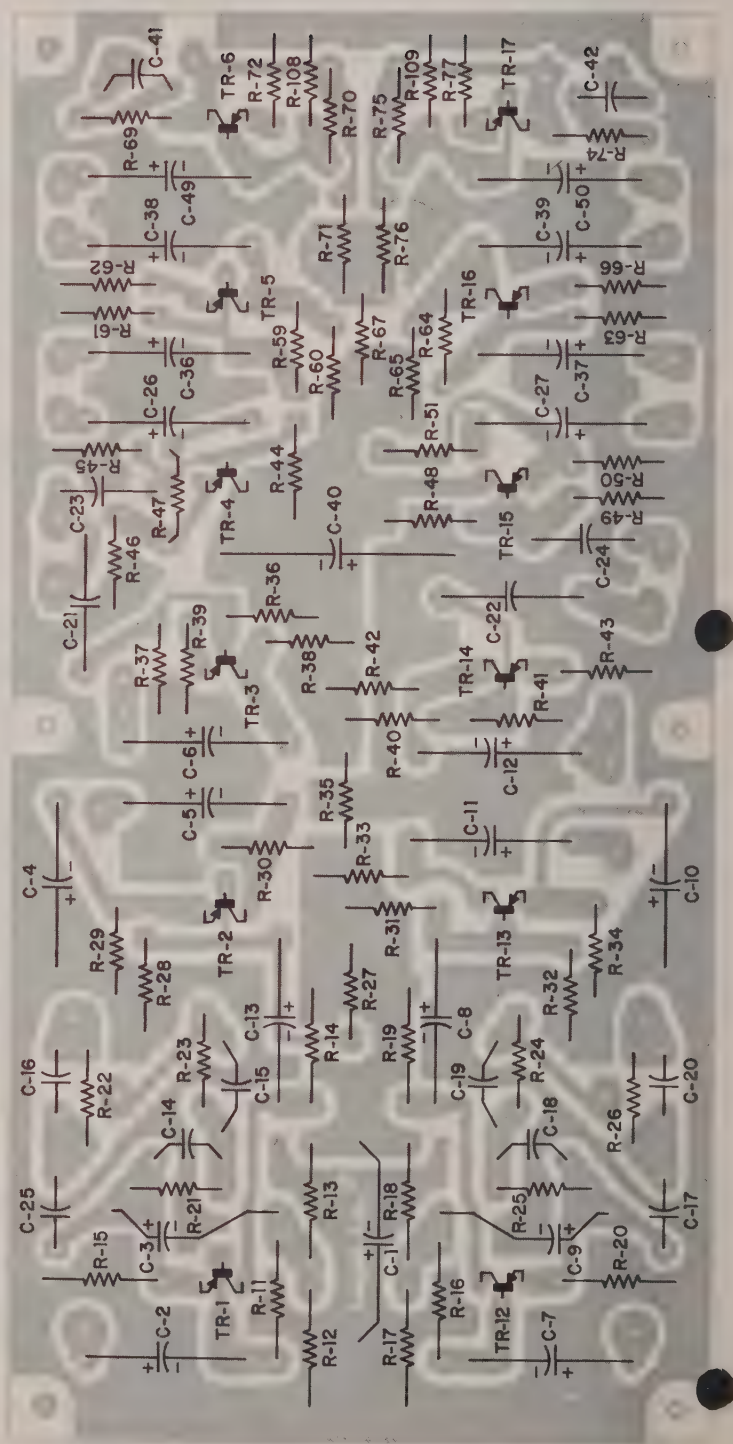


FIGURE 7. LARGE CIRCUIT BOARD SCHEMATIC DIAGRAM

CUSTOM MOUNTING

A full size template is provided for cutting the cabinet panel for custom installation.

- ☐ Remove all the knobs. Use a 3/16″ screwdriver for loosening the setscrews. Be sure to note the position of the dots on the knobs so that they will be remounted in the same position.
- ☐ Remove the ⅜″ nuts and flat washers from the control shaft bushings and save this hardware.
- ☐ Remove the dress panel by pulling it off of the control shaft bushings.
- ☐ Trace the template outline on the cabinet front panel by placing a piece of carbon paper under the template and outlining the cut-out. The carbon paper will trace the outline directly onto the panel that you are going to cut.
- ☐ Carefully cut the panel.
- ☐ From the rear of the cabinet, slide the amplifier (front panel removed) into the cabinet until the front of the chassis is even with the front of the cabinet.
- ☐ Temporarily install the dress panel with a ⅜″ flat-washer and nut on the SELECTOR and FILTERS controls.
- ☐ On the shelf, mark the center of the two rear chassis feet, as closely as possible.
- ☐ Remove the dress panel; then remove the amplifier from the cabinet.
- ☐ Drill two small pilot holes in the mounting shelf at the marks made in step 8. Install a #8 or 10 x ½″ round-head wood screw in each hole.
- ☐ Slide the amplifier back into the cabinet. Engage the centers of the rear chassis feet on the two screws installed in step 10.
- ☐ Place the dress panel over the control shafts. Place a flat-washer over each control shaft bushing. Place a ⅜″ nut over each bushing and tighten only until the front panel is flat against the cabinet panel.
- ☐ Remount the control knobs.

INSTALLING THE METAL CABINET

- ☐ Slide the cabinet over the amplifier. The ventilation slots go toward the rear.
- ☐ Fasten cabinet to amplifier chassis with four #4 x ¼″ thread-cutting screws.

INSTALLING THE WOOD CABINET

SEE FIGURE 8.

Hardware for the following steps is supplied with the cabinet.

- ☐ Slide the front of the amplifier into the rear of the cabinet. The bottom edge of the chassis will slide down grooves in each side of the cabinet. Push the amplifier all the way in to the end of the grooves.
- ☐ Fasten the front edge of the chassis to the cabinet with a ⅝″ self-tapping screw and flat washer.
- ☐ Fasten the rear of the amplifier with two metal brackets. Use two #6 x ½″ wood screws in the cabinet and two #4 x ¼″ thread cutting screws in the chassis.
- ☐ Four rubber feet. Mount to cabinet with #6 x ½″ wood screws.

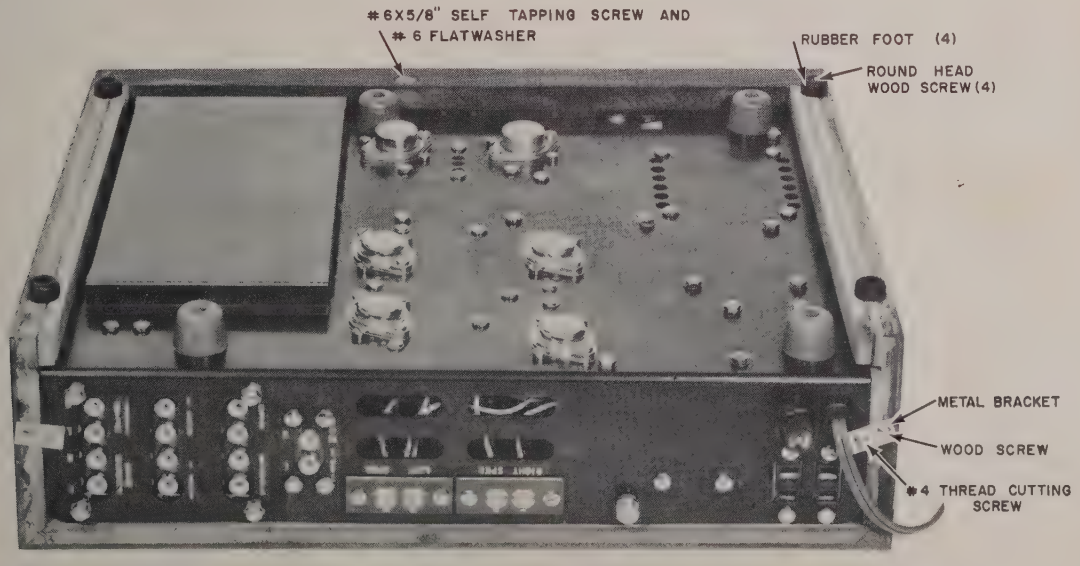
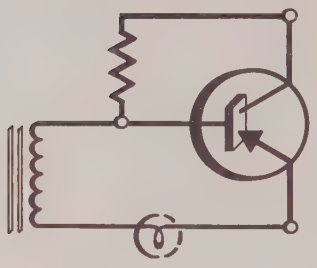


FIGURE 8. INSTALLING THE WOOD CABINET

SIMPLIFIED CIRCUIT DESCRIPTION



This transistor amplifier performs the following functions:

1. Provides a control point where program input sources are selected in pairs. TAPE, PHONO, AUX, and TUNER.
2. Provides frequency equalization for magnetic phono and tape head inputs.
3. Provides independent bass, treble and loudness control.
4. Provides proper output for recording.
5. Provides a large amount of power amplification needed for operating loudspeakers.
6. Provides miscellaneous switching functions: Channel reversing, stereo-mono mode selection, rumble and scratch filtering and speaker phase reversal.

On the facing page is a block diagram of the complete amplifier. This diagram shows the individual functional blocks (transistor and its associated parts) and how the program signals flow from block to block.

Notice that the chain of blocks or stages shown for the left channel is duplicated in the right channel. The selector switch setting determines which pair of input jacks is connected to the amplifier chains. Low-level signals, such as those obtained from tape heads or magnetic phono cartridges, are applied to 1st preamplifier stages. Since the two channels are identical, only the left channel will be described here.

Output of the 1st preamplifier, is applied to the 2nd preamplifier stage, TR-2. Outut from this stage is applied to TR-3, a voltage amplifier. Some of this output is also fed back to TR-1 through RC (resistance capacitance) networks to equalize the tape head and mag phono inputs.

If the SELECTOR switch is set to TUN or AUX, one of the high-level signals coming into these jacks is applied directly to TR-3. The output of TR-3 is fed directly to the left tape REC jack.

A tape recorder connected to these jacks receives an equalized, constant-level signal which is unaffected by the LEVEL, LOUDNESS, or tone controls. The output of TR-3 is also fed through the Tape Monitor switch to the Stereo-Reverse and Stereo-Mon switches. With the tape monitor switch in the SOURCE position, signals coming in through the "front end" are applied to the rest of the amplifier through the stereo switches. Front end refers to the selecting, preamplifying, and equalizing circuits. The rest of the amplifier consists of level control, tone control and power amplification.

If the tape monitor switch is placed in TAPE MONITOR, the front end is disconnected from the power amplifier and supplies signal only to the tape recorder. Playback signal from a three-head recorder now enters the amplifier via the left TAPE MON jack. Thus the actual recorded material is played back or monitored through the music system while recording is taking place.

The STEREO-MON switch allows you to parallel the two channels. The signal emerging from these switches is passed through rumble and scratch filter circuits (as desired) and then applied to TR-4, the tone-control driver stage. This stage drives a passive bass and treble control network. The components of this network are encapsulated into a "packaged circuit", PC-1. Voltage amplifier TR-5 receives the output of PC-1.

TR-5 raises the level of the tone-compensated signal and applies it to the LEVEL control through the BALANCE control. The balance control, when centered or set counterclockwise from center, does not attenuate the left signal. If this control is rotated clockwise from center however, the signal is increasingly attenuated. This permits you to alter the gain of either channel to compensate for differences in incoming level, speaker efficiency, and room acoustics. The LEVEL control is a ganged unit which introduces the same amount of attenuation into each channel, simultaneously. Output taken from the slider of this control is applied to the loudness control circuit.

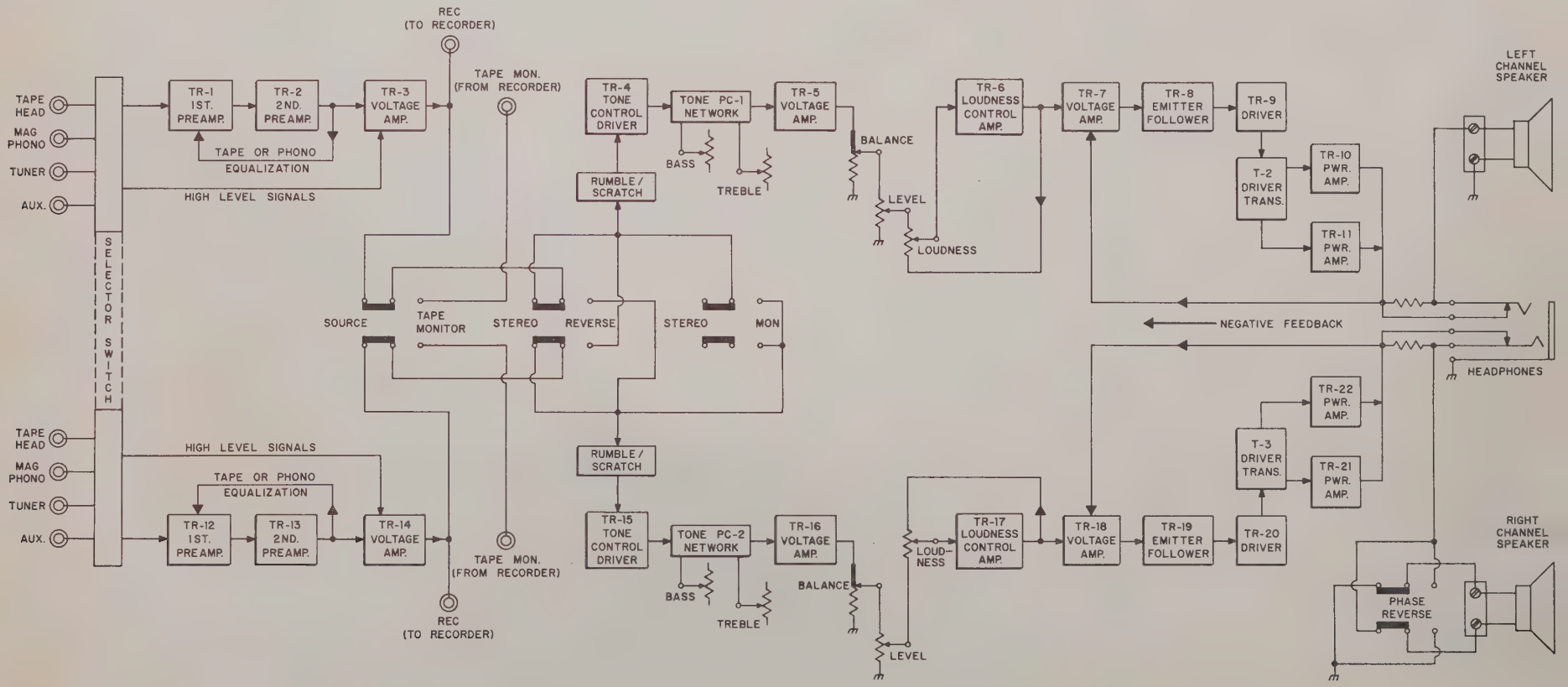
The loudness control circuit uses TR-6 and a feedback network to achieve the loudness compensation desired. The output of TR-6 is applied to TR-7, the first stage of the power-amplifier section of the amplifier. Voltage amplifier TR-7 drives emitter follower TR-8, which in turn is direct-coupled to driver transistor TR-9.

TR-9 is a power type transistor. Its output is applied to the power output transistors through driver transformer T-2. The transformer is used to provide DC isolation and phase inversion for driving the half-bridge output circuit.

The output circuit employs matched transistors in a balanced arrangement. Use of separate + and —30 volt supplies provide a direct coupled output which has no DC component. A DC component would bias the speaker and could cause some distortion.

The power output from TR-10 and TR-11 is applied to the left speaker through the shorting contacts of the headphone jack. If a pair of stereo phones is plugged in, the shorting contacts are opened and a resistor is placed in series with the parallel speaker and headphone combination. This causes the speaker level to drop to near inaudibility, while the headphone level is quite comfortable.

Notice that some output is also fed back to TR-7 to lower distortion produced anywhere in the power amplifier.



BLOCK DIAGRAM OF KG-870 AMPLIFIER

CIRCUIT DESCRIPTION

For simplified circuit description, and a description of the preamplifier and tone control circuitry, refer to page 16 and the block diagram on page 17.

POWER AMPLIFIER DRIVER AND PRE-DRIVER STAGES

Output from TR-6 the loudness control amplifier has been equalized, switched, balanced, and level set. This signal is applied to the base of TR-7, a voltage amplifier. TR-7 is an NPN transistor which is basically operated in the ground-emitter configuration. However, negative voltage feedback is applied to the bypassed emitter of TR-7, from the output of the amplifier. Thus the stage operates to a lesser degree as a grounded-base amplifier. Inverted signal is taken from across collector load resistor R-89 and applied directly to the base of another NPN transistor, TR-8.

TR-8 is operated as an emitter follower with considerable current gain. An in phase signal is developed across R-90 and direct coupled to the base of TR-9. TR-9 is a power-type unit mounted to the chassis-heatsink. TR-9, like all the small signal transistor units, is operated single-ended and thus must be biased class "A".

Class A bias indicates that collector current flows throughout an input cycle. Because current is always flowing through this power transistor it dissipates some heat. The heavy aluminum chassis "heatsinks" away this heat, thus protecting the transistor from excessive temperatures.

TR-9 is also connected as an emitter follower with R-95 and the primary of T-2 as its load. Notice that DC current is kept from flowing through the primary of T-2 by blocking capacitor C-58. This allows more linear operation of the core material in the driver transformer. The transformer serves as a DC blocking component and phase inverter.

These three stages have all been direct coupled to eliminate low-frequency phase shift. Lowest possible phase shift within the power amplifier allows the greatest amount distortion reducing negative feedback to be used, while maintaining good stability. Another benefit derived from direct coupling is excellent low-frequency response.

POWER OUTPUT STAGE

In most amplifiers the output transformers place definite limitations on performance both at the very low frequencies and at the very high frequencies. Transformers that are able to handle large amounts of power inherently have some design compromises in order to provide both low and high frequency response. **The Knight-Kit Half-Bridge, Direct-Coupled output stage is transformerless.** Use of a balanced + and — 30 volt power supply permits the output terminals to be at 0 volts DC.

The output circuit operates modified class B, with R-100 and R-101 providing the necessary forward bias. Some forward bias is needed to eliminate the cross-over distortion that occurs when the signal passes through zero, causing one transistor to stop conducting while the other transistor starts.

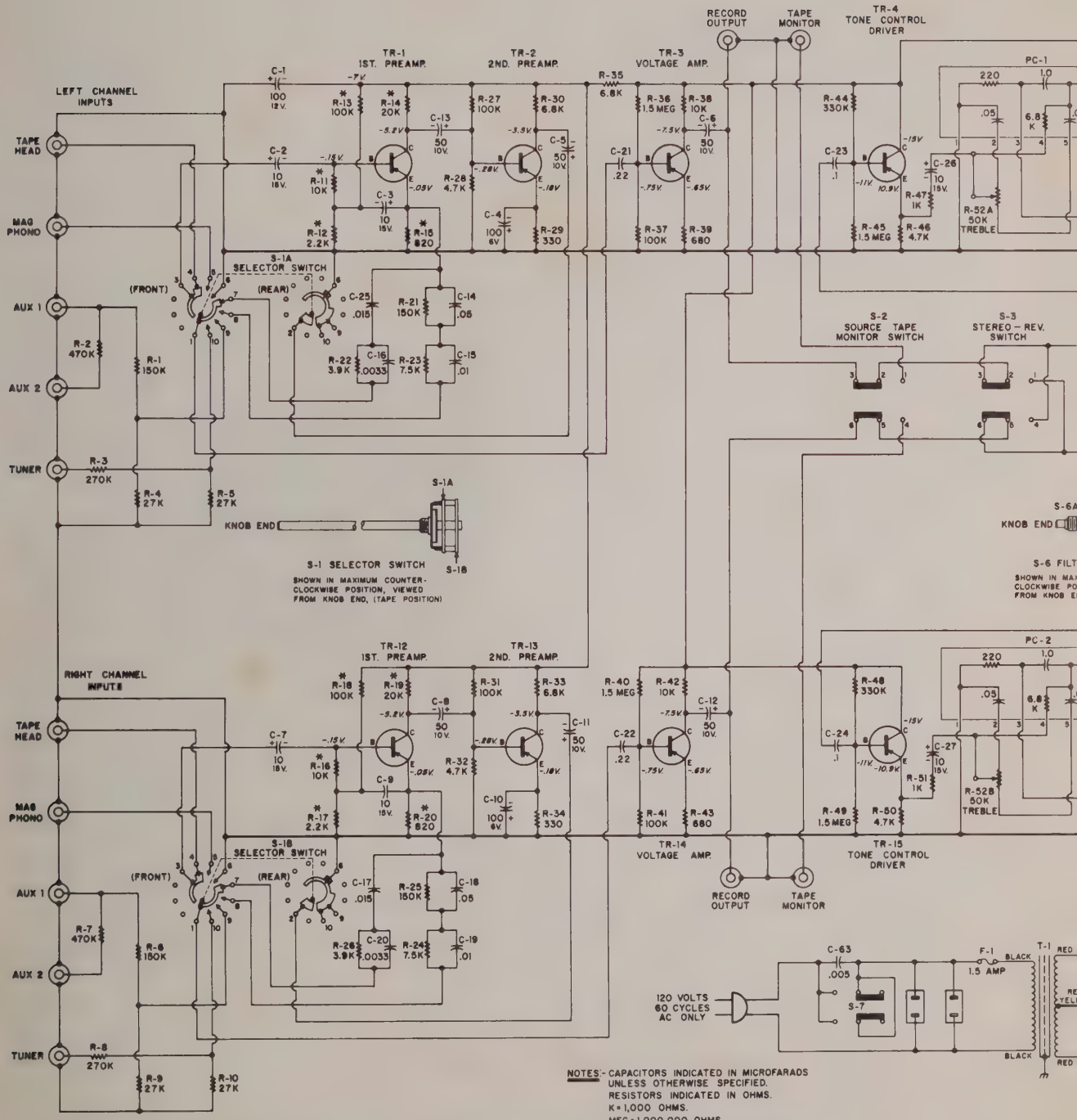
Notice the use of lamp I-2. A filament from this lamp is placed in each emitter lead. These filaments provide DC stabilization, circuit balance and overload protection.

The lamps have been carefully chosen for their positive temperature-coefficient characteristics. Because the filaments are in the emitter circuits, they provide excellent thermal runaway protection. Any tendency for collector current to be continuously higher than normal causes the filament resistance to rise. This in turn reduces the effective forward bias on the transistor, thus limiting the rise in collector current. This action also compensates for slight differences that may be found between the characteristics of the upper and lower transistors. The filaments operate without bypass capacitors because the normal (cold) resistance causes practically no degeneration and the thermal time constant of the filament is long enough, that their resistance cannot rise on signal peaks.

Should a speaker load become shorted, the transistors are protected from excessive dissipation by the lamp; the filaments will light up, changing the bias on the transistors. In the unlikely event that one of the output transistors should short, the speakers are protected by two fast-acting fuses; one in the + supply and one in the — supply.

POWER SUPPLY

The power supply consists of a power transformer, a full-wave silicon diode bridge and various LC and RC filters. The transformer secondary is center-tapped to provide a ground reference for the + and — 30 volt source. A pi type LC filter is employed in each leg. Use of swinging chokes, and silicon rectifiers give excellent supply regulation. Additional RC filter networks are used to supply decoupled, lower voltage to various circuits. Notice that two 3-ampere fast-acting fuses, F-2 and F-3, protect the power supply and speakers from short circuits. F-1 is also used in the primary circuit of T-1 for line protection.



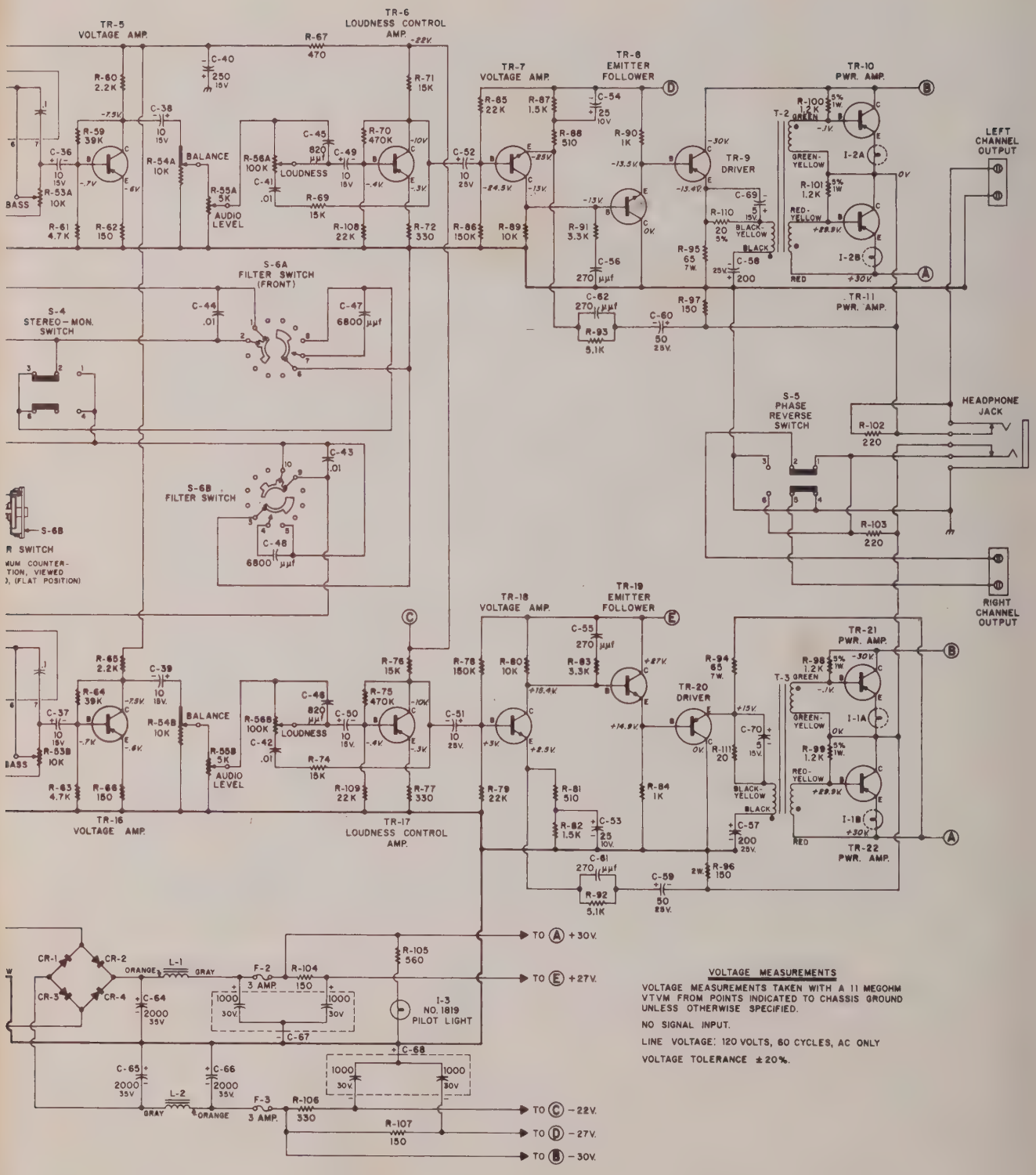
NOTES:- CAPACITORS INDICATED IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
RESISTORS INDICATED IN OHMS.
K = 1,000 OHMS.
MEG = 1,000,000 OHMS.
ALL RESISTORS ARE 1/2 W. ±10% UNLESS OTHERWISE SPECIFIED
* – INDICATES LOW NOISE, DEPOSITED CARBON RESISTORS, ±5%.
⏚ = CHASSIS GROUND.

SELECTOR SWITCH TERMINAL CONNECTIONS

POSITION	S-1B (Rear)	S-1B (Front)	S-1A (Rear)	S-1A (Front)
TAPE	6-9-10	1-7 3-4	6-9-10	1-7
PHONO	6-9-10	1-8 5-3	6-9-10	1-8
AUX	2-6-9-10	1-9 6-3	6-10-2	1-9
TUNER	6-9-2	1-10 3-6-7	6-9-2	3-6-7 1-10

FILTERS SWITCH TERMINAL CONNECTIONS

POSITION	S-6 FRONT	S-6 REAR
FLAT	9-10	1-2
RUMBLE	N/C	N/C
SCRATCH	9-10 3-4	1-2 6-7
RUMBLE/ SCRATCH	3-4	6-7



VOLTAGE MEASUREMENTS

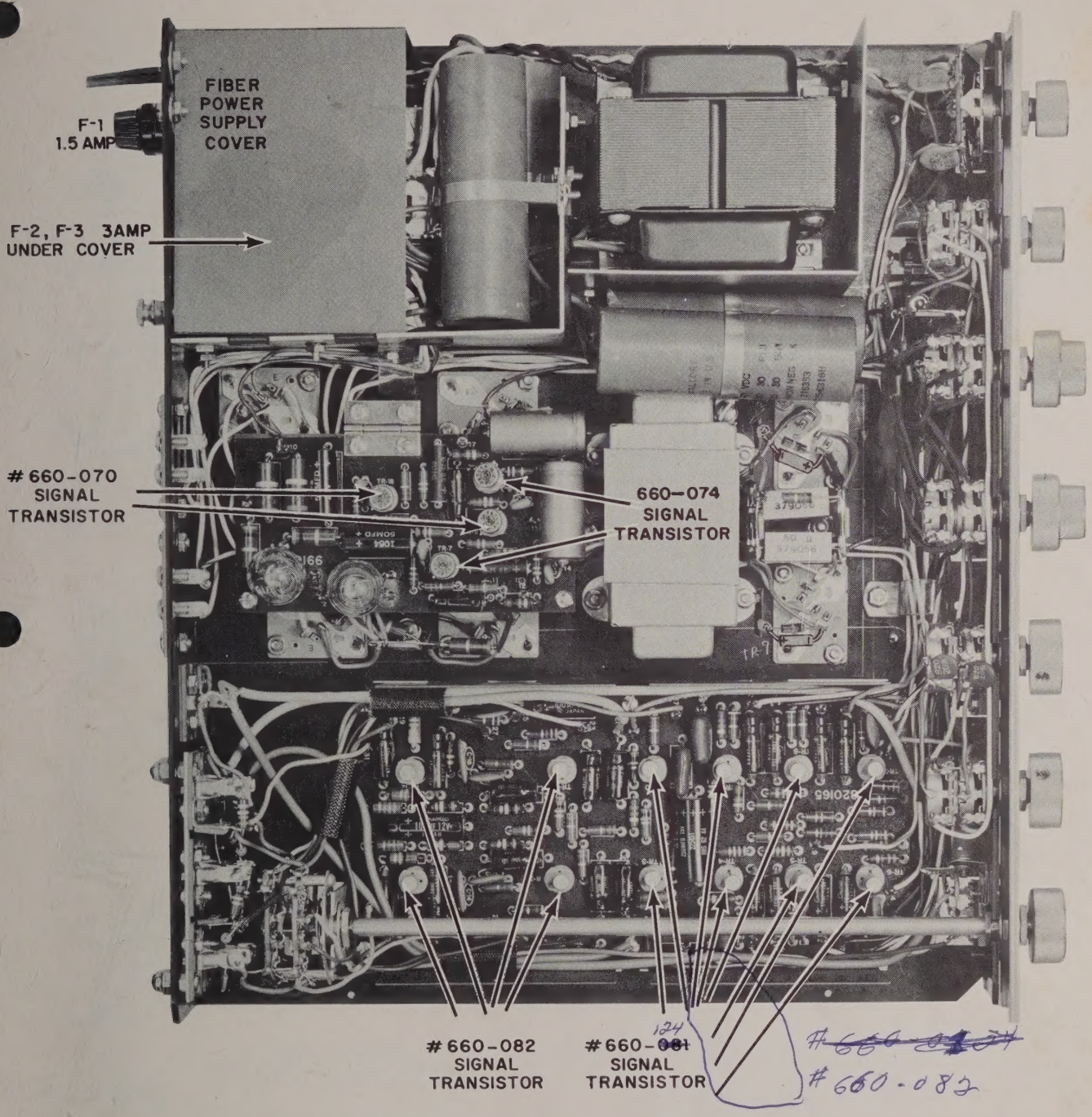
VOLTAGE MEASUREMENTS TAKEN WITH A 11 MEGOHM VTVM FROM POINTS INDICATED TO CHASSIS GROUND UNLESS OTHERWISE SPECIFIED.

NO SIGNAL INPUT.

LINE VOLTAGE: 120 VOLTS, 60 CYCLES, AC ONLY

VOLTAGE TOLERANCE ±20%.

SCHEMATIC DIAGRAM



TRANSISTOR LOCATION

IMPORTANT INSTRUCTIONS

If your unit is not operating properly, first write to our Technical Consulting Service for assistance.

Authorization must be obtained before returning your equipment for service. After you receive your return authorization, please pack your unit in a sturdy shipping carton and tightly cushion with plenty of packing material to avoid costly damage in transit. Send the package prepaid and fully insured to the address at the bottom of this page. Mark the package: FRAGILE — DELICATE ELECTRONIC EQUIPMENT.

If service is required after this warranty period, an estimate will be sent to you before repairs are made.

ADDRESS CORRESPONDENCE AND RETURNED EQUIPMENT TO:

KNIGHT ELECTRONICS CORP.

Knight Service Department

2100 Maywood Drive • Maywood, Illinois 60153

KNIGHT WARRANTY

Your Knight equipment is warranted to be free from defects for a period of (90) ninety days under normal use.

Any defective parts will be repaired or replaced free of charge during the first ninety days from the date of sale.